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THE OPPOSITION TO EUGENICS[1]

By Professor S. J. HOLMES

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THE sanguine eugenist looks upon the improvement of the inborn qualities of the race as an end so obviously worthy that he has difficulty in understanding how any intelligent and normally constituted person can fail to share his own enthusiasm for this cause. Even the man in the street must be aware that it is one of the greatest misfortunes to be ill-born, especially if this should cause one to be hopelessly deformed, blind, idiotic or insane, and that, on the other hand, it is one of the greatest blessings to be well born, to inherit a fine endowment of physical, intellectual and emotional characteristics.

Obviously, people differ in a large number of hereditary traits that profoundly affect their happiness and their value as members of society. It follows inevitably that the race would be much better off if we could eliminate the inherited factors that contribute to fill our asylums with morons and lunatics, and if the race were propagated by those of its members who are above the average in physical vigor, intelligence and emotional traits that make for sound character and a normal happy existence. Here is this race of ours carrying its burden of hereditary defects so numerous that a mere inventory of them would not be possible in the time allotted to this address. In this race of ours are also the genetic factors that afford the physical basis for the development of outstanding personalities whose achievements may be of incalculable service to their fellowmen. How, then, can any one fail to be in fundamental accord with the chief aims of practical eugenics, however great may be the differences of opinion as to how these aims may best be brought about? It seems, therefore, very simple and obvious to the enthusiastic eugenist that racial improvement is

[1] Presidential address before the American Eugenics Society, New York, November 30, 1938.

not only feasible, but that it should at once enlist the whole-hearted support of every well-informed and public-spirited person. If the eugenist is a simple-minded sort of individual, as eugenists are sometimes accused of being, and as in fact a good many of them are, he may be disposed to wonder why others do not find his mistress so fair as she seems to him.

Unfortunately, most people in this world, even educated and cultivated people, are little concerned about eugenics. There are many persons entirely wrapped up in their own affairs who naturally adopt the viewpoint of the man told about by Mark Twain who did not see that he should do anything for posterity because posterity never did anything for him. Some degree of unselfish interest in the welfare of future generations is required if any kind of eugenic doctrine secure approval. There are probably few, let us hope, who would be entirely indifferent to the welfare of posterity if their thoughts were once directed to the subject, although their interest might never be stimulated to give the matter more than a mild and perfunctory approval. Another reason for this indifference is that many people do not possess the knowledge of heredity required for a proper comprehension of eugenics, simple as the elements of this subject are. The only cure for this is, of course, education. But the task of the eugenist is not accomplished simply by the dissemination of knowledge of the elements of his subject, important as this is. The eugenist faces not only a formidable mass of ignorance and indifference, but also a considerable degree of positive hostility. We as eugenists must reckon with the fact that there are many people who do not like us at all. It is to this aspect of our subject that I would invite your attention this evening.

In seeking for the reasons for the opposition to eugenics it is important to bear in mind that the idea of improving the inborn qualities of man is, for the great mass of humanity, of relatively recent origin. To be sure, race improvement through selective breeding had been advocated by Theognis, Plato, Campanella and a few other lonely voices, but their doctrines were regarded more in the light of curiosities of philosophical speculation than as feasible measures for practical application. It was only after the doctrine of evolution came to be finally accepted in the scientific world that eugenics was brought clearly before the reading public as a subject to be seriously reckoned with. It was inevitable that the notion of hereditary variability and change through selection should be applied to man as well as to lower organisms, and that the possibility of further development of the human species should present itself to all who indulge in evolutionary speculation. The thought that man can determine the direction of his own evolution presented a novel and somewhat revolutionary view-point. Now the reception of any new point of view is profoundly influenced by the way in which it fits into the system of ideas already accepted. People are wedded to various brands of political, economic, social, moral and religious doctrine, and their reactions are antagonistic to any new ideas that threaten to unsettle their convictions in any of these fields. Often people scent a danger from afar and become prejudiced against ideas which are not so incongruous with their settled beliefs as they are prone to imagine. This, I believe, is particularly true with regard to the mental reaction of people to eugenics. Let us consider some of the sources of antagonism.

Eugenics is founded upon the doctrine of the natural inequality of man. The extent to which men differ by nature is a question upon which people are inclined to have different opinions on the basis of their political or social philosophy. Those of aristocratic leanings like to think that distinctions of rank and station go along with rather marked differences in hereditary endowment. Champions of equal rights, those who do battle against the powers of vested privilege, take comfort in the thought that the native qualities of the privileged classes are no better than their own, if as good.

There is a wide-spread prejudice in favor of egalitarianism, that tends to cause a reaction against any doctrine which threatens the security of convictions on this score. Nothing, of course, is more obvious than that human beings differ both in physique and mentality. But if these differences are environmentally caused through accident, disease, poor education or economic misfortune, they are, from the racial point of view, relatively superficial and largely remediable; whereas if they result from heredity they might, it is feared, be more difficult to overcome and would also afford a dangerous concession to the claims of aristocracy. If these inequalities can be attributed to the oppression of the prosperous and ruling classes, the moral appeal of the egalitarian gains thereby in strength. In his deservedly famous poem, Edwin Markham asks concerning the man with the hoe:

> Who made him dead to rapture and despair?
> Who loosened and let down this brutal jaw?
> Whose breath blew out the light within this brain?
> . . . Oh, masters, lords and rulers of all lands,
> Is this the handiwork you give to God?
> This monstrous thing distorted, and soul quenched?

The man with the hoe, as Markham pictures him, is a product of the iniquities of his fellowmen, the victim of oppression which has molded him into his repulsive shape. The wide-spread antagonism to the rich and successful classes creates a proneness to minimize their inherent endowments and gives a feeling of satisfaction

in laying at their door the imperfections and failures of the downtrodden and oppressed. This attitude is heightened by a feeling of sympathy for the underdog, the championing of whose cause naturally appeals to our generous and chivalric impulses. The eugenists come in for a good deal of bitter invective because they are charged with teaching that poverty is, *ipso facto,* a proof of biological inferiority. In the class war the eugenists are often represented as arrayed against the exploited workers, whom they are accused by one writer at least of wanting to sterilize *in toto.*

Now, I am not condemning or criticizing these emotional attitudes, nor am I here concerned with how far class distinctions of any kind are founded upon a genetic basis. I am simply concerned with the reasons for a wide-spread emotional attitude toward eugenics. People do not like to believe that large numbers of their fellow creatures are to be branded as inferior physically or mentally as a result of their heredity. They much prefer to attribute the injustices of inequality to man than to nature.

Naturally, the attitudes of people on this subject are determined to a large extent by their political and economic views. This comes out clearly when we consider the prevailing opinion of socialists, communists and radicals of various brands. One finds all sorts of opinion on eugenics among the adherents of all these groups, but one can not fail to sense the prevalent emotional reactions I have mentioned in many adherents of these groups who deal with the human aspects of biology.

The influence of emotional bias in determining opinion comes out even more conspicuously when we consider the problem of the native endowments of different races. One needs only to point to the different attitudes on this subject prevailing in Russia and in Germany in order to show how profoundly views upon what is essentially a problem of genetics are determined by the dominant forces controlling public opinion in these countries. Rarely is the problem discussed anywhere without a tinge of bias one way or another, and these emotional attitudes carry over to a certain extent and influence the opinions of persons as to inequalities within the several races. Pride of race naturally arouses a resentment against the imputation of inferiority of the race to which one happens to belong. On the other hand, there is another emotional attitude that is noticeable in this connection, namely, a desire to take the generous and broad-minded view, to magnanimously concede to other races an equal or even superior endowment to one's own. Often, by way of good form, this is associated with a certain good-humored disparagement of one's own group. Unquestionably this attitude, which is sometimes merely a pose, is conducive to the maintenance of friendly race relations and helps to get rid of some uncomfortable problems. How far it has contributed to bring about the growing sentiment in favor of race egalitarianism it would be difficult to say. It has come to be the fashion to refer to race differences in mentality as if it were now demonstrated that no such differences exist, or, at least, that they are negligible in extent. In the light of our meager and unsatisfactory knowledge and the alternative possibilities of interpretation which existing data permit, this is, I think, a very unscientific position. Certainly a rigid demonstration that races differ in temperament and capacity for intellectual achievement is by no means so easy as it was formerly regarded. But the question is still an open one. Even relatively small average differences, and especially differences in the distribution of mental traits within a race, may be exceedingly important. Concerning the latter topic especially our information as to many racial stocks is very inadequate and we must patiently await further critically tested evidence before coming to final conclusions.

Opinions on the innate capacities of different races and peoples, like those on many other problems, are by no means free from the bias of financial interest. This has shown itself especially in relation to the regulation of immigration. The United States always faces the concrete and intensely practical problem of how to control the influx of aliens who would gain admission to our shores. The immigration of stocks affording a plentiful supply of cheap and tractable labor has been strongly supported by powerful financial interests. The argument that the admission of hordes of cheap laborers would work dysgenically in lowering the average level of our population is naturally countered by the declaration that the disabilities of these stocks are solely the result of their poor education and inferior economic status. Not wishing to incur the opprobrium attaching to the charge that they would sacrifice the future welfare of the country for the sake of securing gain, the promoters of free immigration are led to the egalitarian standpoint as a defense reaction. Considerations of monetary gains may, however, influence opinions as to the innate capacities of different stocks in diverse ways. They may lead to a defense of racial and class equality or to the justification of class distinctions. More frequently it is the latter for which the eugenist is berated as an ally of the capitalist in the endeavor to exploit and oppress mankind.

In this discussion I would emphasize the fact that I am not defending any doctrine concerning the extent to which either races or individuals differ in their endowment of genes. What I wish at present to call attention to are some of the emotional reactions and incentives that tend to shape opinions on these problems. Since very different views on these problems are com-

monly adopted in different regions and by members of different groups, one can not help thinking that the opinions of most people in regard to the natural equality of both individuals and races are determined, like their views on politics and religion, much less by the evidence of facts than by influences of their social environment, and especially by the political and economic theories to which they are wedded.

Another fertile source of opposition to eugenics is the fear that applied eugenics would involve a sacrifice of fundamental human rights which might lead eventually to an intolerable system. Mr. Darrow, for instance, declared: "In an age of meddling, presumption and gross denial of all individual feelings and emotions, the world is urged, not only to forcibly control all conduct, but to remake man himself! Amongst the schemes this [eugenics] is the most senseless and impudent that has ever been put forward by irresponsible fanatics to plague a long-suffering race."

Mr. Chesterton, for whom eugenics means marriage by the police, has worked himself up into a still greater fury than has Mr. Darrow. Eugenics in Chesterton's opinion is an intolerable menace to freedom, a thing to be destroyed root and branch, "a thing no more to be bargained about than poisoning." Mr. Chesterton is opposed to eugenics as he is opposed to prohibition and any and every meddlesome kind of interference with human rights. He is persuaded that the eugenist would ruthlessly invade the sanctity of the most intimate human relationships and direct the matings of human beings as he would breed live stock. Hence this doughty champion of personal liberty felt called upon to pour out his wrath in a fair-sized volume of mingled protest and vituperation.

A contributor to the *Living Age,* writing under the name of "Individualist," in commenting on the proceedings of the First International Eugenics Congress, expresses the fear that "I who write, and you who read, our brothers and our sisters, our children and our grandchildren, are all to be included in the proposed inquisition into the most sacred of our private affairs—an inquisition to be held apparently by self-appointed inquisitors obsessed by the dubious theories of an infant science. We might be chosen as fit, or dismissed as unfit, but we should thenceforward be labeled, classified, and without a rag of reticence left to us. Even were its knowledge of heredity absolute, the inquisition into the private lives of people involved in its proposals and the power it would place in the hands of the inquisitors would prove such a menace to personal liberty that I for one would gladly risk natural degeneration than be involved in an unnatural degradation so monstrous."

The solicitude for personal freedom expressed in the passages quoted is a sentiment which, in these days especially, is worthy of all approval. I have some difficulty in understanding how the last writer could become so thoroughly alarmed from reading the proceedings of the First International Eugenics Congress, but be this as it may, his apprehension became voiced in many other quarters. When the idea of improving human beings by selective breeding first began to impress the public mind people immediately began to have visions of a system of controlled matings as affording the natural if not the only way in which the hopes of the eugenists could be realized. Disparaging references to the methods of the stud farm and the breeding pen became very much in evidence. Unfortunately, some over-zealous enthusiasts gave a certain amount of color to this apprehension. Critics who like to represent the object of their attack in as unfavorable a light as possible raised the battle cry and took up arms in defense of human liberty, but the antagonism aroused proved to be all out of proportion to its justification.

The fear that eugenists might succeed in arbitrarily mating selected human beings without regard to their protests or their attachments elsewhere has, I hope, completely subsided. There remains, however, a good deal of opposition to placing any restriction upon the mating of any one sufficiently sane to be safely at large. We have long prevented the propagation of mentally defective and diseased persons on other than eugenic grounds without creating any outcry over the essential injustice of such a procedure, or without arousing a fear that the restrictions would come to include a much larger proportion of the population. It was only when it was proposed to restrict the propagation of the defective classes on eugenic grounds that the clamor arose. Unquestionably a considerable part of the opposition grew out of a reaction against interference with human rights. This conclusion will be borne out, I am sure, by a perusal of the copious literature that has accumulated on this subject. It is manifestly true in regard to sterilization, especially since this involves a surgical operation which deprives another individual of an important vital function. The imposition of this mutilation against the will of an individual for the sake of protecting posterity from his progeny is naturally apt to arouse an unfavorable emotional reaction that is overcome, if at all, only by a consideration of the more remote benefits to society resulting from this procedure. The menace to personal liberty arising from the sterilization of the unfit is particularly apt to impress the legal mind, and it is not surprising, therefore, that sterilization laws have encountered no small amount of opposition from the legal profession quite apart from any religious or egalitarian bias. Although thirty-one of our states have passed sterilization laws, it is largely because of the sentiments to which I have alluded that these laws have been so little

enforced and in several states have remained practically a dead letter.

The opposition to eugenics on religious grounds springs from a number of considerations, although it can not be said that in general religion has proved to be inimical to the eugenic movement. Many persons believing that all human beings are of equal worth in the sight of God and that this world is merely a recruiting ground to furnish souls for the next, are apt to minimize the importance of human genetics in comparison with the concerns of eternal life. Even a low-grade imbecile, whatever his handicaps in this world, may be eternally blessed in his future existence; hence it would be wrong to prevent his coming into being through any arbitrary interference with the course of nature. Mr. Sommerville, in an article on "Eugenics and the Feeble-minded," published in the *Catholic World*, after condemning the segregation and sterilization of the feeble-minded on the ground that their progeny might become a social burden, declares that "that kind of outrage on human rights in the name of social benefit is what Christianity has fought against since the days of pagan Rome." Christianity has always championed the cause of the meek and lowly and hence it can not approve of any measures that would prevent them from inheriting the earth.

Although the Catholic Church has never opposed the eugenics movement as such, and although many of its official representatives and adherents have espoused the cause of eugenic reform, the Church has set itself strongly against sterilization and birth control by artificial methods as contrary to nature and hence to the law of God. The regulation of reproduction on eugenic and hygienic grounds is conceded as entirely proper in the Pope's Encyclical Letter on Chaste Marriage; the end to be attained by curtailing reproduction is justifiable; but artificial means of attaining it are condemned as sinful. The few voices among prominent Catholics which had been raised in defense of sterilization on eugenic grounds have apparently now been silenced.

One source of opposition to the conclusions of the eugenists voiced formerly more frequently than now is a certain repugnance to the thought that human qualities are transmitted like those of the lower animals, and especially that mental traits and peculiarities are handed on through the physical mechanism of the germ-plasm. Not infrequently we find genius referred to as something almost supernatural in its nature—a sort of God-given trait that transcends the mundane things with which science has to deal. Galton shocked a number of his contemporaries by dealing with genius from the standpoint of the naturalist. To bring genius under the ordinary laws of heredity was almost a sacrilege. But the doctrine of mental heredity in any form was commonly held to have its dangers on account of its supposed materialistic implications. How can the soul, an immaterial entity temporarily associated with the body, be subject to laws of transmission determined by a physical mechanism? Theoretically, at least, any kind of a mind might be conjoined to any kind of a body. The prevailing outlook upon the mind-body problem, which was largely a development from primitive animistic concepts, naturally engendered a reluctance to carrying over to the mental realm the principles that applied to physical reality. The attempt to bring mind under the laws of heredity was to subject it to the laws of the material world and to deprive it of its freedom, its dignity, and even its prospects of eternal existence. The doctrine of mental heredity did not fit quite comfortably into the prevailing notions about mind and body, although there were various ways of harmonizing these view-points.

Although theological preconceptions have tended to influence opinions on the inheritance of mental traits, there are other forces that have apparently proven to be more potent. For a long time psychologists almost totally neglected the possible role of inheritance in the development of the mind. The experience philosophy, which would start the human infant with a *tabula rasa* at birth and explain the genesis of his faculties as a product of environmental contacts, had little use for heredity. Mr. J. S. Mill, who certainly can not be accused of any bias on theological grounds, declared that "of all vulgar modes of escaping from the consideration of the effects of social and moral influences on the human mind the most vulgar is that of attributing diversities of conduct and character to inherent natural differences." A similar standpoint has been expressed by Mr. Buckle, H. George and many other writers.

Adequate recognition of the role of heredity in psychology had to wait until the advent of the doctrine of organic evolution. Among the first to make much use of the concept of heredity in their psychological speculations were Lamarck and, more explicitly and logically, Herbert Spencer, the first edition of whose "Principles of Psychology" was published in 1855. Recognition of the important role of heredity in mental development has been growing for several decades. Many psychologists, on account of the influence which environment and experience obviously exert in the development of mental faculties, are still prone to minimize the role of genetic factors. Many educators and social reformers have apparently looked upon the inheritance of mental traits as affording a sort of challenge to the worth of their efforts. Being concerned with influences which affect the development of mind and character, they are rather dismayed by the thought that nature has set definite and very different

limits to the developmental capacities of different individuals. The doctrine that mental differences depend upon heredity has been condemned as fatalistic, as an obstacle to progress and as tending to paralyze efforts at improvement. It would be much more encouraging to think of all human beings as capable of being molded to the limits of human capacity if the right influences were brought to bear upon them. In his volume on "Education and the Heredity Spectre," a book profoundly influenced by the Herbartian psychology, Mr. F. H. Hayward asserts that "Our physical qualities are inherited from our parents; our mental and moral qualities, however, owing to our impressionability and educability, are mostly superimposed upon heredity." This standpoint is still widely prevalent, but less so than formerly. Out of the abundant investigations in psychology, and especially educational psychology, during the last few decades have come many convincing evidences of the genetic determination of levels of intelligence, and nowadays many psychologists, students of education and social scientists emphasize the effect of genetic differences in mentality to an extent that would hardly be conceded by a conservative and critical eugenist.

Among the emotions and sentiments that determine people's reaction to eugenics there is, especially among intellectuals who have limited their families to below the maintenance level, a certain aversion to admitting that such limitation is in any way racially harmful. Such an admission would tend to be more or less unconsciously suppressed by what Freud calls the Censor, and a very natural defense reaction is to find reasons for holding that there is no real need for alarm over the differential birth rate. In talking with various people on eugenics and endeavoring to sense the influences that have shaped their opinions I have come to the conviction that back of their arguments there is a certain unconscious effort at self-justification. I admit that this is a more or less intuitive judgment, but it is quite in accordance with what we know of human nature. We tend to adopt those opinions that afford us the maximum of self-approval. People who have a goodly number of fine children are usually proud of their contribution and sympathetic toward eugenics. If they have few children or none they are rather more apt to conclude that there are perhaps too many people in the world anyway.

I am sure that I have not exhausted the sources of antagonism to eugenics that have their real basis in emotions and preconceived opinions. Much of the opposition to eugenics is primarily a sort of defense reaction arising out of a concern for ideas or sentiments to which eugenics is felt to be somehow antagonistic. The emotions aroused by eugenic theory or by proposed eugenic practices are varied. Writers who are alarmed over what the eugenists might do to us if they had their way commonly also attempt to minimize the influence of heredity in mental defect and disease, or even, in extreme cases, to deny such influence altogether. If one is prejudiced against legislative meddling in all personal affairs, he is apt to convince himself that adequate grounds do not exist whereby interference would be justified. If he is shocked by the mutilation involved in sterilization, he is apt to maintain that feeblemindedness and insanity are usually not hereditary, and that sterilization would accomplish practically nothing toward their elimination if they were. If one has certain mystical notions about genius and likes to think that it is something that defies all analysis and explanation by scientists, he may persuade himself by some carefully selected instances and by neglecting all statistical investigations of the subject that genius is as apt to come from any one kind of parents as from another, and that heredity has therefore nothing to do with its origin. But I am not attacking these rationalizations. All of them raise definite scientific problems. Highly trained geneticists may, and in fact do, come to different opinions as to a number of the theoretical as well as practical problems of eugenics. They also differ, but less widely, over several problems of genetics. Fortunately, when one is dealing with the genetics of fruit-flies or garden peas different view-points can usually be brought to an experimental test and definitely settled. The geneticist is happily free from any kind of bias resulting from religion, race prejudice or Marxian economics, although I am not entirely certain in regard to the last-mentioned topic. The poor eugenist has to struggle against many difficulties in establishing incontrovertible conclusions, and the geneticist may therefore look down a bit condescendingly upon many of the results of eugenic research. The opposition to eugenics which arises from the inadequate support which the eugenists have adduced for their conclusions is not to be deplored but much of the opposition is ill-founded or based on misunderstanding or ill-grounded fears, and some of it is simply silly. The eugenist faces the task of making his basic theses so well-supported and convincing that they will simply compel acceptance by all qualified judges. These theses should be so solidly founded that even the most captious individual can not find a way of squirming out of conceding their validity. As a rule you can not convince a prejudiced opponent if you leave him the least loophole through which he can escape coming over to your side. Most of the conclusions of the eugenist, however probable they may be, can not be demonstrated with the rigidity of mathematical proof, or with the definiteness of many facts of genetics. In this the eugenist is in the position of the student of statecraft or economics, and I might

add, the practitioner of medicine. In these fields, in default of demonstrated truths for guidance, one must get along on the basis of the best judgments possible in the light of our present knowledge. Eugenic problems arise in which action one way or another has to be decided upon. As Galton pointed out, probability is the basis of eugenics, as in fact it is the basis of the much more exact science of genetics. I think that it may fairly be claimed that the scientific study of eugenic problems has yielded substantial support for several of the basic conclusions of the eugenist. As the difficulties attaching to such research are overcome, we may look forward to the time when eugenics becomes more worthy of the dignity of a true science, and when much of the alarmist and ill-founded opposition to it will have melted away like fog before the rays of the rising sun. It must be conceded that not a little of the criticism directed against eugenics is a very natural reaction to the ill-founded utterances of the eugenists themselves. The conception of eugenics burst upon the world suddenly. Some it inspired with enthusiasm to the point of intoxication and betrayed them, I am sorry to admit, into making many indefensible statements. Early in the history of the eugenics movement Galton stated that "the subject of eugenics is particularly attractive to cranks," and he expressed grave doubts as to whether the newly formed Eugenics Society was not doing more harm than good—doubts which I feel sure he would not have expressed could he have been acquainted with the present work of this organization. That object of Theodore Roosevelt's dread, the "fool reformer," has done eugenics a deal of harm. But writings on eugenics, I am convinced, are improving in quality. It should be the aim of the American Society of Eugenics to do everything in its power to place eugenics on a really scientific basis, to encourage research in this field and to disseminate only sound and sensible views on eugenic problems. The society should welcome members having wide differences of opinion. Sound progress in this field requires constant criticism, but while intelligent and constructive criticism is always wholesome, much of the opposition of the type I have discussed constitutes only an obstacle to progress. Misunderstanding, ill-grounded prejudice and antagonism based mainly on emotional complexes afford formidable impediments not only to carrying out practical eugenic reforms, but to the acquisition and dissemination of eugenic knowledge. These unfortunate impediments tend to deprive eugenics of the recognition and support required for its proper development. A great deal of the present opposition to eugenics has no real excuse for existing, but this opposition is a hard and obstinate fact which should be analyzed and understood if it is to be successfully overcome. I can not, of course, speak for all eugenists, nor all members of the American Eugenics Society, but I may express the hope that this society will make it known that, as eugenists, we are committed to no particular social, religious, political or economic creed, that we are no more concerned with the class war than the botanist or astronomer, that we are quite willing that Mary should marry Jack or any one else provided their progeny will probably not be imbeciles, lunatics or otherwise a burden to society; that we would like to have relatively more progeny from people with fine hereditary endowments, although we do not have the remotest intention of recommending any coercive measures for the attainment of this end; that we look to education and the development of eugenic ideals as affording the basic conditions for any noteworthy eugenic improvement; that we are desirous of encouraging the acquirement of sound knowledge of the biological factors of human evolution in the belief that the proper application of such knowledge will contribute fundamentally and fruitfully to promote the welfare of mankind. With these aims all intelligent and fair-minded people, I think, can not fail to be in accord.

OBITUARY

RAYMOND A. PEARSON[1]
1873–1939

DR. RAYMOND A. PEARSON, Scientist, Administrator, Educator, Planner, Builder, Statesman and Friend.

In a life span of less than the biblical threescore years and ten, Dr. Pearson earned the right to be designated as a leader in each of the six fields of agricultural activity set forth above. To few is it given to achieve that distinction.

Born in Indiana on April 9, 1873, he passed on at his home in Hyattsville, Md., on February 13, 1939, at the age of 66. In the meantime, he had served agriculture for seven years in the United States Department of Agriculture, ten years in New York State, fifteen years in Iowa, nine years in Maryland and, finally, again for three years and more in the Federal Department.

Scientist. While trained particularly in the science and art of dairying, Dr. Pearson spent most of his life in positions requiring administrative knowledge of many sciences and arts. It was his accomplished purpose to gain a personal knowledge of each of these sufficient to enable effective administration and presentation before legislative and administrative bodies.

[1] Tribute presented to the National Capital Chapter, Iowa State College Alumni Association, Founders Day meeting, March 22, 1939.

Administrator. Of Dr. Pearson's forty-four years of active service, practically all were spent in administrative positions. Beginning in 1895, the year after his graduation from Cornell University, he was assistant chief of the Dairy Division of the Federal Bureau of Animal Industry, and all positions held thereafter were administrative. In his case there was not the usual probationary period in less conspicuous positions. From this service in the department, he became successively general manager of the Walker-Gordon Laboratory Company, professor of dairy industry at Cornell University College of Agriculture, commissioner of agriculture for the State of New York, president of Iowa State College, president of the University of Maryland and, finally, special assistant to the administrator of the Farm Security Administration. During this period he also had been president of the New York State Agricultural Society, 1908–1911; president of the Association of Land-Grant Colleges and Universities in 1923, and chairman of its executive committee from 1919 to 1935. In recognition of this long and faithful service, the association voted him a permanent honorary membership on the executive committee.

Educator. After seventeen years in administrative work, Dr. Pearson became president of Iowa State College in March of 1912 and remained in that capacity for more than fourteen years to the end of August, 1926. He then served as president of the University of Maryland for nine academic years, to 1935. In this period of nearly 24 years there was a most amazing development in the curriculums of agriculture, home economics, engineering and science. Of this development President Pearson was not only a part but a recognized leader.

Planner. Perhaps the better word is seer, because without vision there can be no planning. Dr. Pearson saw visions and dreamed dreams and then wrote them down as plans. This was not a one-man process but a matter of the meeting of many minds on the problems and procedures of institutional growth. So Iowa State College was developed, with a plan which has kept it what the founders started, a beautiful as well as a useful institution of learning, in a more than beautiful setting. So, too, was developed the University of Maryland.

Builder. It is one thing to plan and another to build the plan into accomplished fact. Dr. Pearson did both. No greater tribute can be given. Each institution under his administration has permanent mementoes of his ability in making dreams come true in brick and stone and beauty. He built, too, in finer, more priceless and more enduring materials than these. He built spacious and beautiful structures in the imaginations, the personalities and the characters of thousands of the young men and women of America.

Statesman. The characteristics already set forth constitute true statesmanship. The ability to see, to plan and to build are the measure of the administrator whose works shall last and, while they last, shall contribute to the building of the minds and characters of men and hence to the greatness and stability of the nation.

Friend. What has been said has concerned Dr. Pearson primarily as an official of various institutions. There remains yet the privilege of paying tribute to Dr. Pearson as a man and a friend. Many thousands of students, faculty and alumni will remember with pleasure and gratitude his personal interest in their problems, his rejoicing in their successes, his sympathy with their misfortunes and his firm belief in better things to come. His personal interest did not cease with his successive transfers to new fields of labor, but he kept a warm place in his heart for the scenes where he had labored and the people with whom he had been associated in the years before. This characteristic of Dr. Pearson, perhaps more than any other, will remain long in the memories of the Washington alumni of Iowa State College.

RECENT DEATHS AND MEMORIALS

DR. ALFRED STENGEL, vice-president in charge of medical affairs of the University of Pennsylvania, emeritus professor of medicine in the School of Medicine, died suddenly on April 10 at the age of seventy years.

ADOLF CARL NOÉ, associate professor of paleobotany at the University of Chicago, died on April 10 at the age of sixty-six years.

PHILIP E. BLISS, president of the Warner and Swasey Company, Cleveland, manufacturers of astronomical instruments and machine tools, died on April 11 at the age of fifty-three years.

DAVID JULIAN BLOCK, chemist, director of the Block Laboratories, Chicago, died on April 8. He was sixty-four years old.

HENRY A. WISE WOOD, chairman of the board and formerly president of the Wood Newspaper Machinery Corporation, inventor of modern high-speed newspaper presses, died suddenly on April 9 at the age of seventy-three years.

AT a memorial service held at the Cornell University Medical College for Dr. Charles R. Stockard, president of the board of the Rockefeller Institute for Medical Research and head of the department of anatomy of the college, who died on April 7 at the age of sixty years. The speakers included Dr. William Ladd, dean of the college; Dr. Herbert S. Gasser, director of the laboratories of the Rockefeller Institute, and Dr. James Ewing, director of Memorial Hospital, New York.

IT is stated in *Nature* that it is proposed to estab-

lish a trust fund to the memory of the late Professor Henry E. Armstrong. At the Finsbury Technical College and later at the Central College, South Kensington, Dr. Armstrong and his co-workers, Dr. Ayrton and Dr. Perry, tried out and established the principles of technical education in Great Britain, and thus encouraged the foundation of polytechnics and technical colleges. The hope is for a memorial fund amounting to about £3,000. This will provide a guarantee fund to give, as it accumulates, enough to ensure the publication (or to give substantial financial assistance in the publication or preparation) of any original works, within Professor Armstrong's recognized interests, that it would otherwise be impossible to publish. Publications will carry as frontispiece a portrait of Professor Armstrong, a biographical note and a reference to the foundation and objects of the trust. Furthermore, the fund will provide for a memorial plaque, or bust, for the City and Guilds College, South Kensington.

SCIENTIFIC EVENTS

THE NETHERLANDS GRAVITY EXPEDITION

HER Majesty's submarine O–16 of the Netherlands Navy will leave Holland for the East Indies in May, on a new extensive gravity expedition sponsored by the Netherlands Geodetic Commission. The ship will be commanded by Lieutenant-Commander B. C. Meurs Schouten. The route of the expedition has been carefully planned in such a way that valuable scientific results may be expected. The submarine will proceed by way of Dakar, Capetown, and Durban to Java. The research will be carried out by Dr. W. Nieuwenkamp, attached to the Netherlands Geodetic Commission, which is to continue the gravity of the sea, so successfully pursued by Dr. F. A. Vening Meinesz on recent expeditions.

Observations will be made both with the multiple pendulum apparatus and with a new pendulum instrument of long period which was constructed for the measurements of the ship's accelerations and the determination of Browne's second order corrections. For timing the pendulum observations, the older chronometer will be replaced by the crystal chronometer constructed by the Bell Telephone Laboratories. This fundamental method for improving the timing of the pendulums was first used in 1937 on the U. S. Navy-American Geophysical Union Expedition under the direction of Dr. Maurice Ewing, who, together with Dr. Morison, perfected its application. The crystal chronometer was sent to the British Admiralty for their gravity cruise last summer by the International Commission on Continental and Oceanic Structure (Dr. R. M. Field, chairman), and is now on loan to the Dutch Navy under the same auspices. The increase in precision introduced through the use of the crystal chronometer has also been demonstrated on land by Ewing, Woolard and Johnson in investigations of the geological structure of the eastern coastal plain and reported by Dr. Ewing to the American Philosophical Society in 1937.

The Netherlands expedition will record its soundings by the echo method with the collaboration of naval authorities in effecting the special arrangements needed. It is anticipated that soundings will prove possible even when proceeding on the sea's surface and that a continuous series of soundings will give valuable data for the entire route of the submarine. It is expected that the results of this expedition will greatly assist in answering such questions as: (1) how generally deep ocean basins show positive anomalies as have been found in nearly all cases on previous trips; (2) whether gravity anomalies in the Atlantic west of Morocco show evidence of the continuation of the tectonic folding axis of the Moroccan mountain range; (3) whether the Mid-Atlantic Ridge and the Walfish Ridge in the South Atlantic are in isostatic equilibrium, and other geophysical questions arising concerning the areas crossed by the route. Observational material relative to gravity in the region of the Indian Ocean up to the present time is exceedingly scarce.

The expedition is indicative of important results that may be obtained through international cooperation, and it is hoped that a preliminary report will be included in the report of the Commission on Continental and Oceanic Structure at the Seventh Assembly of the International Union of Geodesy and Geophysics which is to convene in Washington next September.

THE SOIL CONSERVATION SERVICE

IN the annual report of H. H. Bennett, chief of the Soil Conservation Service, it is stated that during the past fiscal year farmers in 18 of the 25 states which had enabling legislation organized 72 soil conservation districts, with a total area of more than 38 million acres. By the end of June, 34 of these districts had entered into cooperative agreements with the Soil Conservation Service, and the farmers of 18 districts were already actively engaged in conservation work.

Farmers in conservation districts have provided virtually all supplies and materials required for erosion control measures, and the contribution of the Soil Conservation Service has been limited generally to technical service for planning and to types of labor

and equipment not normally available on the farms within the districts. During the year, Soil Conservation Service demonstration work on privately owned land was continued and expanded. Operations were started on 18 new projects, and 59 demonstration projects were placed on a maintenance basis. At the close of the year, regular operations were being carried forward in 55 demonstration areas. In 111 other areas, erosion control measures were being maintained for continued demonstrations.

These projects, together with the erosion control work areas adjacent to Civilian Conservation Corps camps under technical direction of the Soil Conservation Service, comprised approximately 11½ million acres of privately owned land, and involved the cooperation of over 61,000 farmers and ranchers. Under terms of the cooperative agreements between the farmers and the service, more than 850,000 acres of land originally in cultivation will be converted eventually to uses less conducive to erosion. By the end of the year, 490,000 acres in the demonstration areas had been retired from cultivation and were being developed as permanent pasture, meadow or woodland.

Another development was the extensive spread of erosion control practices from service demonstration areas to outlying farms. Such soil-defence measures as strip cropping, contour tillage and winter cover cropping were adopted on a far wider scale than in any previous year. Land protection by terracing gained support in virtually every state. The service continued to direct an extensive erosion-control and land management program on four large western watershed projects where nearly 80 per cent. of the land is in public ownership. Efforts to reestablish the range cover in these areas were continued. During the year, conservation nurseries furnished 145 million trees and shrubs, mainly for use in demonstration areas; although some were supplied to Federal and state agencies cooperating in erosion control. Over two million pounds of field-crop and grass seed were furnished to cooperating farmers and agencies.

The service continued its program of basic research. By the close of the year, sixteen experiment stations were developing and testing principles and measures for combatting wind and water erosion. A new experimental watershed project was established near Hastings, Nebr., and work was continued at two similar projects near Coshocton, Ohio, and Waco, Texas. At these three watershed research projects, rainfall and stream flow over relatively large areas are being studied in relation to soil erosion and flood control.

EXPANSION OF FACILITIES AT THE WORCESTER POLYTECHNIC INSTITUTE

THE trustees of the Worcester Polytechnic Institute have recently authorized a $1,000,000 building program. However, expansion of the facilities at the college does not mean any increase in the restricted enrolment. The freshman class each year is limited to 180 students.

The first building to be erected will be a student activity center to cost $350,000, including a library and auditorium with a seating capacity of 975. Funds have been given the college as a memorial to a man prominent in the early development of the institute and his name will be given to the building at the time of its dedication. It will be erected on the west campus adjacent to Sanford Riley Hall, the freshman dormitory. Ground will be broken before commencement and the building should be completed by June, 1940.

The program also embraces an addition to Salisbury laboratories, now in construction, and remodeling of the old building, at a cost of $100,000; erection and equipment of a mechanical engineering building, $400,000; refitting the old mechanical engineering laboratories for the civil engineering department, $65,000; erection of a footbridge connecting the east and west campus, relocation of the tennis courts, development of a quadrangle on the west campus and remodeling of Boynton Hall for the use of the department of mathematics and construction of a faculty lounge, $85,000.

Plans for the mechanical engineering laboratory are being prepared and it is expected construction will be started within a year. Erection of this building has been made possible by bequests in the wills of Willard L. Ames, of New York, who was graduated in 1882, and Moses B. Kaven, of Worcester, who received his degree in 1885. Trustees and alumni propose to obtain additional funds for endowment and equipment. It is expected that the entire program will be completed by the opening of the fall semester in 1942.

LABORATORIES OF THE DELAMAR INSTITUTE OF PUBLIC HEALTH AT COLUMBIA UNIVERSITY

THE new laboratories and classrooms of the DeLamar Institute of Public Health of Columbia University will occupy the top three floors of the seven-story city health and teaching center nearing completion at the Presbyterian-Columbia Medical Center, 168th Street and Broadway. The building has been erected through an agreement by the Presbyterian Hospital, the trustees of Columbia University and the Department of Health of the City of New York. Its facilities will enable medical students at Columbia to receive practical training in public health similar to that which they receive in medicine. The laboratories and courses will also be open to physicians, dentists, nurses and graduate students. The plan has been worked out under the general direction of Dr.

John L. Rice, commissioner of health, and has the hearty endorsement of the university.

The first four floors of the building will be used by the city as headquarters for maternal care, child welfare, nursing and other public health services. The center will be one of the few to offer treatment to both tuberculosis and venereal disease patients.

The laboratories and research rooms above will be so equipped that they may be used for any field of research in public health. A model classroom, built to comply with the standard requirements of a public-school classroom in the city of New York, is situated in the southeast corner of the seventh floor. Besides being used for lectures, the room will provide opportunity for research into procedures necessary to protect the health of school children. The fifth floor will contain a laboratory designed specifically for research into diseases caused by industrial occupations and a statistical office where a complete record of the number, kinds and occurrences of various diseases may be kept. The general laboratory for students and research workers will be situated on the sixth floor.

The seventh floor will also house an air laboratory equipped for the study of the various sources of contamination of air in public places. A bacteriological laboratory, on the same floor, will contain all the modern equipment necessary for the study of bacteriology. The offices of Dr. Haven Emerson, executive officer of the institute, and his staff will be connected with individual laboratories completely furnished with chemical, physical and bacteriological facilities for private research. A water laboratory, a sterile room, a machine shop and three laboratories for general research complete the arrangements for the top floor.

There will also be a library, a student lounge and staff accommodations. The ground floor will contain an auditorium and exhibit hall where public health education will be carried on under the direction of the institute and of the Department of Health.

SYMPOSIA IN PHYSICS AT THE UNIVERSITY OF CHICAGO

Two symposia of interest to physicists are to be held at the University of Chicago from June 23 to 30, as follows:

I. *Symposium on Liquids and Polyatomic Molecules,* a joint symposium of the chemistry and physics departments, to be held on June 23 and 24 and on June 26 and 27.

The first part of the symposium is devoted to the liquid state (structure of liquids, viscosity, condensation of liquids, the fusion process, two-dimensional liquids, infrared absorption and hydrogen bonding). The second part includes discussion of visible and ultra-violet spectra of complex molecules, the color of dyes, refractivity, optical activity and liquid and molecular viewpoints in nuclear structure. The speakers include K. F. Herzfeld, B. E. Warren, J. G. Kirkwood, O. K. Rice, F. A. Ogg, Jr., J. E. Mayer, H. Eyring, W. D. Harkins, W. H. Rodebush, L. Pauling, R. S. Mulliken, E. Teller, J. Franck, T. R. Hogness.

II. *Symposium on Cosmic Rays,* June 27 to 30. The subjects to be discussed include:

The Intensity and Absorption of Cosmic Rays.
Geographic and Geomagnetic Effects.
Time Variations of Cosmic Rays.
Composition of Cosmic Rays.
Energy Distribution of Cosmic Rays.
Showers and Bursts.
Mesotrons and Other Heavy Particles.

The expected participants include:

P. Auger from Paris; W. Bothe and W. Heisenberg from Germany; P. M. S. Blackett and B. Rossi from England; J. Clay from Holland; G. Herzog from Switzerland; C. Anderson, V. F. Hess, T. H. Johnson, R. A. Millikan, W. F. G. Swann and M. S. Vallarta from elsewhere in the United States, and A. H. Compton, W. P. Jesse, M. Schein and V. Wilson from Chicago.

SCIENTIFIC NOTES AND NEWS

FIVE members of the Rockefeller Institute for Medical Research, all of them members of the National Academy of Sciences and two of them Nobel laureates, having reached or passed the age of sixty-five years, are retiring from active work. These are Dr. Alexis Carrel, who announced his retirement a year ago; Dr. Florence R. Sabin, who retired early this year; Dr. Karl Landsteiner; Dr. Phoebus A. Levene and Dr. Winthrop J. V. Osterhout. The mandatory retirement rule is being enforced in all organizations with which the Rockefeller foundations are connected. It is stated that pensions will be given and that every laboratory facility will be provided to enable those who retire to continue their research work on their own responsibility if they desire to do so.

PORTRAITS of ten past presidents of the Explorers Club, New York City, were unveiled on April 9. These were Rear Admiral Robert E. Peary, General A. W. Greely, Dr. Frederick A. Cook, General David L. Brainard, Carl E. Akeley, Vilhjalmur Stefansson (present president), George G. Heye, James B. Ford, Roy Chapman Andrews and Dr. Walter Granger.

A NEW Hall of Optical Science, part of the Division of Light, Vision and Optics, was opened on April 20 at the New York Museum of Science and Industry in

Rockefeller Center. The opening of the exhibition was marked by an anniversary luncheon in honor of William Bausch, vice-president of Bausch and Lomb Optical Company, whose experiments in optical glass manufacture, begun just twenty-five years ago, have resulted in notable achievements in this branch of American industry. Following the luncheon, the guests inspected the new exhibition, after which it was opened to the public.

THE doctorate of laws was conferred on April 14 on Dr. James Bryant Conant, president of Harvard University, at the Founders' Day ceremonies at Tulane University.

DR. ROBERT HEGNER, professor of protozoology at the Johns Hopkins University, has been elected a corresponding member of the Belgian Society of Tropical Medicine.

THE Order of Balboa was conferred on April 10 by the President of the Isthmus of Panama on Dr. William M. James, chief of the medical clinic at Panama Hospital, in recognition of his "work on tropical medicine, especially malaria and dysentery." Dr. James was formerly a member of the Health Department of the Canal Zone.

THE King of England has approved the award by the Royal Geographical Society of the Royal Medals as follows: The Founder's Medal to Arthur Mortimer Champion, for his surveys of the Turkana Province and the volcanoes south of Lake Rudolf; the Patron's Medal to Professor Hans Ahlmann, of Stockholm, for his exploration and glaciological studies in the Arctic. The Council awarded the Murchison Grant to Robert Bentham, for his mapping and geological investigations in Ellesmere Land; the Back Grant to Lieutenant Commander R. E. D. Ryder, R.N., for his captaincy of *The Penola* and his marine surveys on the British Graham Land Expedition; the Cuthbert Peek Grant to W. Vaughan Lewis, for his physiographical studies in Great Britain and Iceland; the Gill Memorial to J. V. Harrison, for many years' exploration in Central and South America and Southern Iran.

DR. PAUL W. BOUTWELL, professor of chemistry at Beloit College, was elected president of the Wisconsin Academy of Sciences, Arts and Letters at the recent annual meeting, held at the University of Wisconsin.

MR. ELLIOT, British Minister of Health, has been made president of the Public Health Congress to be held at Hastings by the Royal Institute of Public Health and Hygiene from May 23 to 27.

RICHARD WINGATE LLOYD has been elected a vice-president of the Franklin Institute, and Philip H. Ward, Jr., a member of the museum and of the memorial committee, has been elected a member of the board of managers. Mr. Lloyd has been a member of the board since 1934 and chairman of the museum and memorial committee since 1935.

PROFESSOR W. SPENCER HUTCHINSON, head of the department of mining engineering at the Massachusetts Institute of Technology, will retire at the close of the academic year. He has been a member of the faculty for seventeen years and has been head of the department since 1927, when he succeeded Dr. Waldemar Lindgren.

DR. S. W. FLETCHER has been appointed acting dean of the Pennsylvania State College and Experiment Station. He succeeds Dr. R. L. Watts, dean and director since 1912, who retired on January 1 with the title emeritus. Dr. Fletcher will continue to assist in the program of the Cooperative Wildlife Research Unit, which is sponsored jointly by the college, the Pennsylvania Game Commission and the U. S. Bureau of Biological Survey.

ARTHUR L. COOK has been appointed director of the School of Science and Technology of Pratt Institute, Brooklyn. He was head of the department of electrical engineering until last May, when he became acting director of the school.

DR. HUGH S. CUMMING, formerly Surgeon General of the United States, sailed on April 12 to attend medical conferences in Paris, Geneva and Scarborough, England. In Paris he will attend the meeting of the Permanent Health Office on April 23, in Geneva the Conference Health Committee of the League of Nations, beginning on May 4, and in England the International Medical Congress, which opens on July 1.

DR. WALTER T. SWINGLE, of the Bureau of Plant Industry, U. S. Department of Agriculture, sailed on April 8 for Rio de Janeiro. He went on the invitation of Dr. Oswaldo Aranha, Minister of Foreign Affairs of Brazil. Dr. Swingle will confer with Brazilian experts about the possibilities for the establishment of new agricultural industries, especially for export purposes. He will be gone for three months.

LLEWELYN WILLIAMS, curator of economic botany at the Field Museum, Chicago, who is now on leave in Venezuela to aid the government botanist, Dr. Henri Pittier, in the botanical exploration of that country, recently made a trip from Caracas across the Venezuelan Guiana, by way of Ciudad Bolivar and La Paragua. He was accompanied by Captain Felix Cardona, of the Venezuelan Frontier Commission. They journeyed in canoes up the Caroni River to regions very little explored botanically.

DR. W. M. MANN, director of the National Zoological Park, Washington, D. C., sailed on April 7 for South America with a consignment of animals that he plans

to present to zoological parks in South American countries. He also will collect animals to bring back to the park in Washington.

DR. R. RUGGLES GATES, professor of botany in the University of London, King's College, took part in the celebrations in honor of Spallanzani at Pavia, held from April 10 to 14. He was a delegate from the Royal Institution and gave an address on "The Nature of Genic Differences."

THE title of the Pilgrim Trust Lecture to be delivered by Sir William Bragg at 8:30 P.M., on Monday, April 24, at the Washington meeting of the National Academy of Sciences is "History in the Archives of the Royal Society."

DR. W. F. G. SWANN, director of the Bartol Research Foundation at Swarthmore, gave a report of the work of the foundation at a meeting of the Franklin Institute in Philadelphia on April 19.

THE James Arthur Lecture on Time and its Mysteries at New York University will be given in the auditorium of Gould Memorial Library, University Heights, on April 26, at 8:30 P.M., by Dr. Arthur H. Compton, professor of physics at the University of Chicago. The subject of the lecture will be "Time and the Growth of Physics."

DR. CHARLES A. SHULL, professor of plant physiology at the University of Chicago, on March 30 addressed a joint meeting of the University of Kansas chapters of the Sigma Xi and the Phi Sigma and the Kansas Academy of Science. He spoke on "The Plant in Relation to the Water System of Its Environment."

PROFESSOR CARL C. SPEIDEL, of the School of Anatomy of the University of Virginia, gave an address entitled "Living Tissues in Action" before the New York University Chapter of Sigma Xi on April 4.

AT a colloquium in the department of zoology of Columbia University on April 11, Dr. Robert Cushman Murphy, of the American Museum of Natural History, presented an illustrated paper entitled "Insular Isolation Among Birds: a Discussion and Inquiry."

JEROME ALEXANDER addressed the Sindicato dos Quimicos do Rio de Janeiro on March 16 on "Colloid Chemistry and Some of Its Applications." A dinner followed at Pax Hotel, with about seventy-five chemists present.

A SERIES of popular science lectures sponsored by the Illinois State Museum for the season of 1938–39 was brought to a close on March 30 when Dr. J. Marvin Weller, of the Illinois State Geological Survey, spoke on recent experiences "Behind the Lines in China." The lectures were free to the public and were given monthly from October to April. The speakers, in addition to Dr. Weller, were: Dr. J Harlen Bretz, glaciologist, University of Chicago; Dr. W. M. Krogman, physical anthropologist, University of Chicago; Dr. John A. Wilson, director of the Oriental Institute; Dr. George D. Fuller, plant ecologist, University of Chicago; Dr. Henry B. Ward, zoologist, University of Illinois.

THE twentieth annual meeting of the American Geophysical Union and its seven sections (Geodesy, Seismology, Meteorology, Terrestrial Magnetism and Electricity, Oceanology, Volcanology and Hydrology) will be held in Washington, D. C., on April 26, 27 and 28. At the regular sessions of the sections, scientific papers will be presented. The principal feature of the general assembly, which will be held in the auditorium of the National Academy and Research Council Building on the afternoon of April 28, will be a symposium on geophysical prospecting. At this symposium papers will be presented as follows: geophysical methods in petroleum exploration, by J. Brian Eby; electrical and magnetic exploration in the mining industry, by Sherwin F. Kelly; and geophysical prospecting by the Federal Government, by F. W. Lee, J. H. Swartz and Irwin Roman. On the evening of April 27, a smoker will be held in Building D of the George Washington University, 2013 G Street, N.W.

THE *Experiment Station Record* states that the eighteenth International Congress of Agriculture will be held in Dresden from June 6 to 12, under the auspices of the International Confederation of Agriculture. It will be organized into sections of agrarian policy and farm management; agricultural instruction and propaganda; agricultural cooperative societies; cultivation of plants; viticulture, fruit growing and the cultivation of special plants; animal production; agricultural industries; rural life and the work of the countryman; and agricultural sciences (including the organization and encouragement of research in the field of agriculture).

THE Section on Education of the American Association for the Advancement of Science will hold a series of meetings and symposia and a dinner at the summer meetings of the American Association for the Advancement of Science, which are to be held in Milwaukee, Wis., from June 19 to 24. The meetings of Section I will take place on Tuesday and Wednesday, June 20 and 21. The program is in charge of Dr. Hulsey Cason, of the department of psychology of the University of Wisconsin, who is acting as secretary *pro tem.* All members and fellows of the association who wish to read papers at these meetings are urged to send abstracts of not more than 150 words to Dr.

Cason, so as to be received by him not later than May 20.

WEDNESDAY, July 13, has been designated as Engineers' Day at the Golden Gate International Exposition by the San Francisco Engineering Council, which is sponsoring it as a red-letter day in the history of engineering achievement. The engineering profession is invited to attend this commemoration of the engineer's contribution to human welfare. This celebration will occur during the week of national conventions of the American Society of Mechanical Engineers and the American Institute of Mining and Metallurgical Engineers. It closely follows the national conventions of the American Institute of Electrical Engineers, the Institute of Radio Engineers and the American Association for the Advancement of Science. It closely precedes the national convention of the American Society of Civil Engineers and Western Chemical Congress. As all these meetings are to be held in San Francisco or vicinity, the time and place is particularly appropriate. The program calls for a morning assembly on Treasure Island with an address by an internationally known speaker, an afternoon inspection of the outstanding engineering and industrial exhibits at the exposition and an evening banquet.

THE herbarium of the late Professor Glen P. Van Eseltine, botanist, of the N. Y. State Experiment Station at Geneva, has been given to Keuka College, New York, and is now installed. Professor Van Eseltine had made a special study of Carex for some twenty-five years and the herbarium contains a large number of critically named specimens both of his own collection and of others obtained by exchange. The other specimens represent a large number of species found around Washington, D. C., and in central New York.

DISCUSSION

A CLASSIFICATION OF WEEDS AND WEED-LIKE PLANTS

A SERIES of discussions with various geneticists has led me to suggest a classification for weeds and weed-like plants. The word "weedy"—oftentimes used in quotation marks (Babcock and Stebbins,[1] 1938, p. 61)—does not always carry the same connotations to cytogeneticists as it does to taxonomists. The classification suggested below or some similar classification should remove the difficulty. While weeds and cultivated plants are included as two kinds of peregrinators, the initial division has been made on the spreading capacities of a species rather than on its association with man. The amount to which a species travels from place to place, whatever the cause, will determine the extent to which may be broken down the external barriers between previously isolated groups (species, races, populations, etc.). Plants which spread *with* man may be expected to exhibit the same cytological and taxonomic phenomena which are shown by those spread *by* him.

PEREGRINATORS (weeds and weed-like plants):

A. Cultivated plants
   Plants intentionally grown by man
B. Weeds
   Plants unintentionally grown by man, in fields, gardens, pastures, lawns, etc.
C. Ruderals
   Plants spreading into man-created habitats (barnyards, roadways, dumps, etc.) though not actually cultivated.
D. Nomads
   Plants spreading widely and rapidly even when not associated with man. Here belong many potential weeds and here apparently was the source of many of our weeds. Species for the most part of river valleys, seashores and other habitats marked by bare and shifting soils. This group forms a series of transitions to

NON-PEREGRINE SPECIES:

The bulk of indigenous floras

It is a remarkable fact (with very natural explanations) that geneticists have worked largely with peregrinators and taxonomists largely with non-peregrine species. In order to obtain the necessary pedigree cultures geneticists have had very largely to limit themselves to the adaptable, easily germinated cultivated plants like maize, snapdragons and primroses; to weeds and ruderals like Datura; or to genera like Nicotiana and Crepis the bulk of whose species are among the peregrinators of one class or another.

The ability to spread beyond external barriers which has made the peregrinators good material for genetical experiments has at the same time made them taxonomically difficult. When a taxonomist says that a species is "weedy" he usually means not that it necessarily grows in cultivated fields, but that it has the taxonomic phenomena associated with most weeds. These phenomena, while they have scarcely been discussed in scientific literature, certainly exist. When I recently pressed an able taxonomist for a working definition of a weed, he immediately replied, "A species which is very common, very aggressive, very variable and which clutters up herbaria."

Correlated investigations in taxonomy and cyto-

[1] E. B. Babcock and G. L. Stebbins, Jr., *Publ. Carnegie Inst. Wash.*, 504: 1–199, 1938.

genetics are already beginning to contribute to both sciences (see, for instance, Babcock and Stebbins, 1938, and Riley,[2] 1938). The integration of these two disciplines can go forward more smoothly if it is generally realized that they have worked with different materials as well as by different techniques.

EDGAR ANDERSON

MISSOURI BOTANICAL GARDEN,
WASHINGTON UNIVERSITY

OAT HAY POISONING

IN eastern Wyoming cattle are occasionally poisoned by ingesting oat hay or oat straw. Sheep and horses are not believed to be affected. The first loss reported to us occurred in October, 1934, at which time twenty-nine head of cattle of both sexes and of all ages died within a few hours after eating well-cured oat hay. Since 1934 other cattlemen have reported losses under similar conditions. Losses due to oat hay have also been noted in limited areas in other states.

Investigators[1,2] at the Colorado State College have published two progress reports on oat hay and straw poisoning. Because oat hay brings about symptoms of asphyxia and death due to asphyxiation, they suspected hydrocyanic acid as the cause of death but were unable to show its presence in the feed and only rarely could show a trace of this poison in the paunches of animals which had died from eating oat hay. They found cyanide antidotes to be of no benefit.

In this laboratory, using toxic oat hay from Dayton, Wyoming, it has been found that eleven pounds of this hay will kill a 350-pound steer in about nine hours after feeding. A water extract of eleven pounds of the same hay caused another steer of similar size to go down with typical symptoms from which he later recovered. In both instances a chocolate brown color in the blood was observed. This was found, by means of the spectroscope, to be due to high concentrations of methemoglobin in the red blood cells. This was confirmed by the conversion of this pigment into reduced hemoglobin by the addition of hydrogen sulfide. The cells are not laked and the plasma remains clear and straw-colored. Another calf fed toxic oat hay from Gillette, Wyoming, showed no symptoms nor any methemoglobin in the blood six hours after being fed. Three hours later the animal was down with typical symptoms and a high concentration of methemoglobin was present in the blood at that time. This animal survived and the following morning showed no symptoms, nor could methemoglobin be found in a blood sample taken at that time.

[2] Herbert Parkes Riley, *Amer. Jour. Bot.*, 25: 727–738, 1938.

[1] Newson, *et al.*, *Jour. Am. Vet. Med. Assn.*, 43: 66, 1937.

[2] F. Thorp, Jr., *Jour. Am. Vet. Med. Assn.*, 45: 159, 1938.

The formation of high concentrations of methemoglobin in the blood of cattle poisoned with oat hay explains the asphyxial symptoms produced and also offers an explanation for the subsequent abortion in pregnant cows receiving sublethal doses of this feed, for during the period of partial asphyxia of the mother the fetus is probably killed by asphyxiation and is later aborted. The fact that the poisonous principle is stable towards heat and soluble in water will be of great value in its ultimate isolation and identification.

In Wyoming toxic oat hay or straw develops in restricted areas on heavy soils usually in the foothill regions. It is not known to us what influence, if any, the soil may have upon the development of the toxicant. Nor are we prepared at this time to suggest what influence climatic factors may exert. Meager records lend support to the belief that toxic oat hay or straw may be expected to develop on the same plot of ground. This point has not been confirmed experimentally. Poisonous oat hay may develop on dry land or irrigated farms. Acute deaths have resulted from ingesting the green oat plants in toxic areas. Preliminary investigations therefore indicate that the toxicant is formed during the oat-plants development. The localization of the problem suggests that local influences must be of basic significance.

W. B. BRADLEY
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EARLY MAN IN WESTERN AND NORTHWESTERN CANADA

Two discoveries made in Canada by the anthropological field party of the University of New Mexico in 1937 and 1938 have significant bearing upon the problems relating to early man in North America. The object of the field program was to locate sites for excavation, make a general archeological survey and look for evidence of early man in relation to glaciation and possible early migration routes from Asia. It is the opinion of the organizer that there is a need for more physical evidence of early American cultures and culture complexes. Arguments pro and con have been presented for the existence of man in North America during the Pleistocene or ice age. Therefore, it was thought advisable to form a definite program for work in the glaciated and unglaciated areas of western Canada and Alaska in order to correlate, if possible, some of the early cultures with glacial chronology. This work was supported by a grant from the Penrose Fund of the American Philosophical Society and by the University of New Mexico.

Yuma artifacts were found as far north as Ponoka, Alberta, about sixty miles south of Edmonton. Yuma sites were located in southeastern Alberta and south-

western Saskatchewan. Folsom and Yuma artifacts were found in collections made in the vicinity of Calgary and in other collections extending as far east as Regina, Saskatchewan. The collection made by K. H. Jones near Mortlach, Saskatchewan, and described by Edgar B. Howard,[1] indicates that the Folsom complex is post-Wisconsin in age. Mortlach lies within the Altamont (Coteau) moraine, which is dated by W. A. Johnston[2] as probably being the terminal moraine of the Wisconsin movement. The Folsom artifacts of Jones's collection belong to the true Folsom type[3] found in Colorado and New Mexico and are not of the questionable Folsom type sometimes known as Folsomoid, Folsom-like or Generalized Folsom. The same holds for the Folsom points from Alberta. Unless there was a long period of time during which Folsom points were manufactured, the whole Folsom complex may be dated as post-glacial. If glaciation is used as the criterion for the division between Pleistocene and post-Pleistocene, it follows that the Folsom complex is post-Pleistocene.

Near Loon Lake at the top of a pass between the Mackenzie and Yukon drainages, about eighty miles south of the Arctic coast, artifacts were found on terraces above the summit of the pass. These artifacts were flaked by the percussion method. No projectile points were found on the site, though future excavations might produce them. The crudeness of these artifacts and the types found indicate upon comparison with other American artifacts that they belong to an early culture phase. They are similar to the Lake Mohave, California,[4] finds of the W. H. Campbells. They are also similar to the artifacts found by M. R. Harrington on the lowest and oldest horizon at Borax Lake, California.[5] Not only is there a close resemblance between the artifacts, but both the Loon Lake site and the lowest cultural stratum of the Borax Lake site failed to produce projectile points. These artifacts may represent an early American culture which in a number of respects can be compared with the paleolithic of Europe, although making this comparison does not necessarily imply that there is any connection between European and American finds, either in time or culture sequence. The comparison of early American stone implements with those of the European eolithic, paleolithic, and neolithic types is in all probability a false premise when such comparison is made to show that the two cultures are of the same antiquity. Northern and central Asia will undoubtedly be the areas that will produce artifacts that may be safely correlated with American finds. More work on early American archeology should be done in the glaciated areas where chronological dating in relation to the glacial periods is possible.

WESLEY L. BLISS

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THE BLUE JAY CACHED THE NUT

IN SCIENCE for January 13 of the present year, Arnold Gesell asks, "What did the blue jay do with the nut?" The west window of my Tropical Research Laboratory in the New York Zoological Park opens on an extent of lawn enclosed by shrubs and trees. This is a favorite place for the nut caches of grey squirrels. Scores of acorns are buried, some within a yard of the window.

This last autumn at least two blue jays have systematically robbed the squirrels. One bird which I watched, perched in a nearby tree. Within two minutes after a nut was pushed down and covered up by a squirrel, the jay was on the spot, and soon unearthed the acorn. It then flew up, perched for a few seconds, then returned to another part of the lawn, and jammed the nut into the ground, driving it home with repeated blows of its beak. This happened at least four times within an hour, and perhaps oftener. Two jays repeated this performance many times within a period of several weeks.

WILLIAM BEEBE

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SOCIETIES AND MEETINGS

THE PENNSYLVANIA ACADEMY OF SCIENCE

THE regular spring meeting of the Pennsylvania Academy of Science was held on April 7 and 8 at the Pennsylvania State College. A total registration of 157 is reported. Eighty-seven papers were read, distributed among the sciences, chiefly genetics, geology, pharmacognosy, physical sciences, botany and zoology. The annual dinner was held at the Nittany Lion Inn on Friday evening. Following the dinner, an illustrated lecture was delivered by Dr. Arthur B. Cleaves, geologist with the Pennsylvania Turnpike Commission. Dr. Cleaves spoke on "Pennsylvania's All-Weather Highway." This is the new road which is tunnelling the mountains between Chambersburg and Pittsburgh.

The following officers were elected: *President,* Dr. R. W. Stone, Pennsylvania Topographic and Geologic Survey; *President-elect,* Professor H. W. Thurston,

[1] Edgar B. Howard, *American Antiquity,* 4: 3, January, 1939.

[2] W. A. Johnston, "Quaternary Geology of North America in Relation to the Migration of Man; The American Aborigines," University of Toronto Press, 1933.

[3] Howard, *ibid.*

[4] Southwest Museum Papers, No. 11, 1937.

[5] Charles A. Amsden, correspondence.

Pennsylvania State College; *Vice-president,* Dr. C. A. Horn, Albright College; *Secretary-Treasurer,* Dr. V. Earl Light, Lebanon Valley College; *Press Secretary,* Dr. Bradford Willard, Pennsylvania Topographic and Geologic Survey.

Simultaneously with the meeting of the academy, 210 members of the Junior Academy met under the direction of Professor Karl F. Oerlein, Pennsylvania State Teachers College at California. It is planned to hold the 1939 summer meeting at Laporte, Pa., when geologic and biologic field trips will be arranged. The regular meting for 1940 is to take place at Washington and Jefferson College, Washington, Pa. The dates of these meetings are to be determined and announced later.

BRADFORD WILLARD,
Press Secretary

THE OKLAHOMA ACADEMY OF SCIENCE

THE twenty-seventh annual meeting of the Oklahoma Academy of Science was held at Oklahoma Agricultural and Mechanical College, Stillwater, Oklahoma, on December 2 and 3, 1938. Of the 478 members, 275 attended the meeting. One hundred and twenty-five papers were presented in the various sections.

President Charles M. Perry presented the annual presidential address on Friday noon, December 2. The title of his talk was "The Doctrine of Levels Applied to the Sciences." Dr. Howard Odum, professor of sociology at the University of North Carolina, gave the annual address on Friday evening. The title of his lecture was "Social Conditions in the South." Another outstanding event of the meeting was an address by Dr. W. B. Bizzell, president of the University of Oklahoma at Norman. Dr. Bizzell spoke on "Regionalism in Public Life."

A research award of $50 for 1938, financed by the American Association for the Advancement of Science, was made to Dr. Henry Artis Miley, of Oklahoma A. and M. College. Dr. Miley is investigating tarnish films on copper. L. D. Alley of Enid and Oneta Carroll of Newkirk, two outstanding students from the state high school science clubs, were elected for honorary membership in the American Association for the Advancement of Science. The annual business meeting was held on Saturday, December 3. The following officers were elected for 1939:

President: H. D. Chase, University of Tulsa.
Vice-President, Section A: Roy M. Jones, Central State Teachers College.
Vice-President, Section B: Hugh M. Eley, University of Oklahoma.
Vice-President, Section C: Mark R. Everett, Medical School of the University of Oklahoma.
Vice-President, Section D: S. L. Reed, Oklahoma A. and M. College.
High School Relations Committee: Ora M. Clark, Bristow, and James G. Harlow, Oklahoma City.
Secretary-Treasurer: G. L. Cross, University of Oklahoma.
Assistant Secretary-Treasurer: H. I. Featherly, Oklahoma A. and M. College.

G. L. CROSS
Secretary-Treasurer

ACTIVITIES OF THE CUBAN SOCIETY OF NATURAL HISTORY

THE Cuban Society of Natural History (Sociedad Cubana de Historia Natural "Felipe Poey") held a memorial session on the one hundredth anniversary of the arrival in Cuba of three noted German naturalists: John Gundlach, Louis Pfeiffer and Edward Otto.

These three scientists, who had planned to go on to Central and South America, landed in Havana on the 5th of January, 1839. Gundlach, being unable to continue his trip to Surinam, Dutch Guiana, stayed in Cuba for the rest of his life and worked intensively on the Cuban fauna, building up a museum, the collections of which are to-day kept at the Instituto de la Habana. Pfeiffer, during his short stay, collected many mollusks and later was in constant correspondence with Gundlach, who supplied him with much material, enabling him to work extensively on the Cuban shells. Pfeiffer, due to his knowledge of mollusks, was called the "prince of malacology." Otto, botanist, collected a great number of plants from this tropical island. As a result of the work done by these scientists during the past century, the Cuban society rendered a hearty tribute to them at the University Museum (Museo Poey) in the University of Havana. This session, under the direction of Dr. Carlos de la Torre, president of the society, at the same time inaugurated its new board of governors, which had been elected last December to serve during 1939.

LUIS HOWELL RIVERO
UNIVERSITY OF HAVANA

REPORTS

FINANCIAL STATUS OF THE BIOLOGICAL STAIN COMMISSION

THE Commission on Standardization of Biological Stains was organized nearly 20 years ago under the auspices of the National Research Council. The expenses in connection with organizing the work were borne by the Chemical Foundation. Later, as the work developed and as its possibilities for service to biologists became more and more evident, increasing support was obtained through the generosity of the foundation, until about 1928 one or two annual appropriations of roughly $10,000 were thus granted the

commission. Up to date, the total of such appropriations has been slightly over $100,000. This continued support over a period of at least 18 years, during much of which time the income of the Chemical Foundation has been steadily decreasing, is evidence of the interest of that body in the work of the Stain Commission. Biologists who feel that this work has been of any value in assuring them reliable stains must acknowledge a decided debt of gratitude to the Chemical Foundation and to its president, the late Mr. Francis P. Garvin.

Up to 1931 the entire cost of administering the Stain Commission was borne by the foundation. By this time, however, the commission was beginning to earn some income of its own: Its publication work, which had been self-supporting from the beginning, was by that time realizing a small profit, and an appreciable income was being received from the stain companies through fees charged for testing their products and through the sale of certification labels. Inasmuch as the income of the Chemical Foundation, derived chiefly from royalties on patents, was then decreasing, it was decided that the commission must be made as nearly self-supporting as possible. As a result the foundation's appropriations were progressively decreased, and all possible efforts were made to increase the commission's earned income.

By 1933 the appropriations had been cut down to $3,200 a year and have remained approximately at that figure ever since. The balance was at first made up partly by current earned income and partly by using publication profits which had been put aside during the more prosperous years. During the last two or three years current earned income together with the foundation's contribution has been sufficient. The latter has amounted to only about 45 per cent. of the entire budget. Although efforts have continually been made to increase the earned income, it has not yet become sufficient to balance the budget completely. In a sense the stain testing is self-supporting, for it yields sufficient income to pay for all the time actually spent on routine testing. Unfortunately, however, the rest of the time of the assistants doing the work must be paid for, and the present earned income does not cover that. Since the balance of their time is largely spent on investigation, it can be said that it is only the research of the Stain Commission that must be supported by some outside organization. As the last year has seen a noticeable increase in the earned income, probably $2,000 annually from such outside source would now be sufficient.

At present, when such is the financial situation of the commission, the support of the Chemical Foundation must be entirely withdrawn. This comes about through no lack of interest on the part of the officers of the foundation, but merely because its patents are expiring and its income accordingly diminishing rapidly. It raises the question, however, whether the work of the Stain Commission must be stopped or so seriously curtailed as to destroy its efficiency, merely because of the lack of the comparatively small sum of money mentioned above.

This matter is now called to the attention of biologists. The executive committee feels that the work of the commission is of some use to biologists and that it would be unfortunate if it should have to stop or to be badly crippled when it lacks so little of being self-supporting and its need is probably only temporary. If any users of stains feel similarly on the subject and have any practical suggestions to make, communications from them in regard to the matter would be greatly appreciated.

E. V. COWDRY
LOUIS GERSHENFELD
H. E. JORDAN
S. I. KORNHOUSER
F. B. MALLORY
J. T. SCANLON
W. D. STOVALL
H. J. CONN, *Chairman*,
Executive Committee of Commission on Standardization of Biological Stains

SPECIAL ARTICLES

THE LOSS OF RESISTANCE TO MURINE TYPHUS INFECTION RESULTING FROM RIBOFLAVIN DEFICIENCY IN RATS[1]

FROM observations on the intracellular behavior of typhus rickettsiae at various temperatures in plasma tissue cultures and in Maitland cultures, one of us[2] concluded that the unrestricted multiplication of these organisms, resulting in distention of infected cells, might be dependent upon a lowering of intracellular metabolic activity.

In view of the fact that the essential feature of riboflavin deficiency is believed to be interference with intracellular oxidation processes[3] it seemed, on theoretical grounds, that the susceptibility of experimental animals to typhus infection might be greatly enhanced by this type of dietary deficiency. The preliminary

[1] From the Department of Pathology, Harvard Medical School, and the Harvard Dental School, Boston, Massachusetts.

[2] Henry Pinkerton, *Arch. Exp. Zellforsch.*, 15: 425, 1934.

[3] A. G. Hogan, *Jour. Am. Med. Assn.*, 110: 1188, 1938.

experiment to be reported here strongly supports this hypothesis.

METHOD OF PRODUCTION AND COURSE OF THE DIETARY DEFICIENCY STUDIED

Albino rats (Wistar strain) weighing 40 to 50 grams, from a stock kept on Purina dog chow were placed in individual cages with raised screen bottoms (½-inch mesh) and given *ad libitum* water and the following diet:

	Per cent.
Casein (flavin-free)[4]	18
Salt mixture[5]	4
Dextrose	32
Corn starch	31
Rice polishing concentrate[6]	6
Lard	5
Cod liver oil	4

Growth ceases after the third week on this diet. Sore and swollen eyelids and a definite keratitis appear after 6 to 8 weeks, followed by clouding and ulceration of the cornea.[7] Irregular loss of hair occurs on the face, shoulders and back. The skin of the extremities becomes dry, rough and often swollen and ulcerated. Animals survive on this diet for from 10 to 14 weeks, and show all the typical symptoms of riboflavin deficiency.

EXPERIMENTAL OBSERVATIONS

One rat showing advanced symptoms of the deficiency, one moderately advanced, and three showing early symptoms (after only 7 weeks on the above diet) were injected intraperitoneally with Mexican typhus virus. The inoculum used for the first two rats contained large numbers of rickettsiae, while that used for the last three rats contained relatively small numbers of organisms. For controls, 2 rats in an advanced stage of vitamin A deficiency were injected with large doses of rickettsiae, and three rats on a normal diet with relatively small doses.

The five riboflavin-deficient rats all died on the fourth, fifth and sixth days after injection. The peritoneal surfaces of all five of these rats were bathed with a mucinous exudate, sufficient in amount to allow the accumulation of about 0.5 cc from each by scraping lightly with a dull knife. Smears of the exudate from each case showed large clumps of serosal cells distended with rickettsiae in every low-power field. In many preparations practically every serosal cell was distended. This picture was found in female rats as well as in male rats. The distention of these cells was often so great that the nuclei were compressed into small hyperchromatic spherical masses. The exudate also contained many polymorphonuclear leucocytes, which were often heavily laden with rickettsiae, and many extracellular rickettsiae, probably escaped from ruptured serosal cells. In at least four of these rats, death was undoubtedly due to typhus infection, since uninjected rats in the same group survived them by several weeks.

One of the vitamin A deficient rats died on the sixth day after injection, at a time when death from the deficiency alone was anticipated. The peritoneal surfaces showed no grossly demonstrable exudate. Moderate numbers of extracellular rickettsiae were found in smears made by scraping the peritoneal surfaces of this rat. Very few rickettsia-laden cells were found, however, and no distended cells comparable to those which were seen in great numbers in the riboflavin-deficient rats. In view of the large original dose, it seemed possible that many of the organisms seen may have been survivors from those originally injected. The other vitamin A deficient rat was killed on the eighth day after injection. The peritoneal surfaces were normal and no rickettsiae were found in smears. One of the three rats on normal diet was chosen arbitrarily and killed for study on the fifth day after injection. Here again there was no peritoneal exudate. A few extracellular rickettsiae and a rare infected cell were found in smears from the peritoneum of this rat. The other two rats on a normal diet showed no external evidence of infection and were allowed to recover. It is well known that endemic typhus is never a fatal disease in normal rats.

Regaud-fixed Giemsa-stained sections of the tissues of three of the above riboflavin-deficient rats were studied. These sections furnished additional evidence of the markedly lowered resistance of these animals to the rickettsial infection. Not only were the majority of the serosal cells found to be laden with rickettsiae, but the endothelial cells in several organs were similarly invaded. In many areas, for example, every third or fourth Kupfer cell in the liver was greatly distended with these organisms. Rickettsiae have not previously been demonstrated in the Kupfer cells of experimental typhus animals under any conditions.

DISCUSSION

The above observations are believed to be of interest for several reasons. The technique described may well prove to be an important supplement to the methods now in use for the production of vaccines in rickettsial diseases. It is also possible that the method may be used advantageously in the study of filtrable viruses,

[4] Extracted twice over night with 60 per cent. alcohol and twice by refluxing for two hours with 95 per cent. alcohol.

[5] U. S. Pharmacopoeia XI.

[6] Borden Company, New York.

[7] O. A. Bessey and S. B. Wolbach, *Jour. Exp. Med.*, 69: 1, 1, 1939.

especially those which have a relatively low virulence for experimental animals under normal conditions. Studies of this type of deficiency in experimental animals of other species are in progress.

SUMMARY

Riboflavin deficiency, even in a relatively early stage, greatly lowers the resistance of the rat to endemic typhus, thereby resulting in a fatal disease. Not only the serosal cells, but also the endothelial cells in several organs, notably the Kupfer cells of the liver, become greatly distended with rickettsiae under these conditions. Preliminary experiments strongly suggest that advanced vitamin A deficiency, even when making animals markedly cachetic, does not have a comparable effect. Riboflavin deficient animals remain alive for several weeks with an abnormal intracellular metabolism. This type of deficiency is worthy of further study as a possible method of approach in the investigation of other intracellular parasites and filtrable viruses. Speculation regarding the mechanism concerned also suggests the desirability of a study of the effects of this deficiency upon the production of immune bodies in general.

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PRELIMINARY NOTE ON THE MODE OF UNION OF THE GALACTURONIC RESIDUES IN PECTIC ACID

CONSIDERABLE progress has been made in recent years in the field of the chemistry of pectic acid, particularly through the investigations of Link and his co-workers. However, the essential points in its structure are still missing, namely, the exact position of the linkage of the individual residues of the galacturonic acid, their ring structure and the length of the chain (if pectic acid has a straight chain structure). Levene and Kreider recently limited the place of union of the individual residues to positions (4) or (5). The choice between the two has not yet been made.

For the purpose of obtaining the missing information, pectic acid has been exhaustively methylated. The product thus obtained had a composition corresponding most satisfactorily to a structure composed of approximately six units.

$C_{50}H_{90}O_{37}$.	Calculated.	OCH_3, 45.80
	Found.	OCH_3, 45.40

On saponification the substance had the following methoxyl value:

$C_{50}H_{78}O_{37}$.	Calculated.	OCH_3, 34.18
	Found.	OCH_3, 34.30

Whether the material is only a methylated fragment of pectic acid can as yet not be stated. The deduction as to the length of the chain of this material is tentative, inasmuch as it is based only on the methoxyl value in the fully methylated and in the saponified material. More precise information on this point is expected from the analysis of the methylated polygalactoside, obtained on reduction of the above material. This substance has now been prepared by heating the exhaustively methylated material with copper chromite catalyst in an atmosphere of hydrogen at a temperature of 175° and a pressure of 3,500 pounds per square inch during 6 hours. The product has been obtained in only a fair degree of purity, having the following composition:

$C_{50}H_{102}O_{31}$.	Calculated.	C 52.9, H 8.1, OCH_3, 48.81
	Found.	C 53.8, H 8.0, OCH_3, 47.33

As far as can be judged from the rate of hydrolysis of the fully methylated pectic acid, the galacturonic residues seem to have a furanose structure, for after 2½ hours heating of the product with 0.01 *N* hydrochloric acid, at 100° C., about 1½ equivalents of reducing groups are developed and after 15 hours, about 3 equivalents. The methyl ester of 2,3,4-trimethyl α-methyl-d-galacturonide under identical conditions remained unchanged. (R. S. Tipson.)

Thus, it seems suggestive that the galacturonic acid residues of pectic acid have a furanose structure and hence the union of the individual residues is through carbon atom (5).

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VITAMIN E AND NUTRITIONAL MUSCULAR DYSTROPHY

IN 1931 Goettsch and Pappenheimer[1] described a dietary deficiency disease in rabbits and guinea pigs characterized by dystrophy of the voluntary muscles. Morgulis and Spencer,[2] Morgulis, Wilder and Eppstein,[3] found that at least two factors, both contained in whole wheat germ, were required for the prevention or cure of the disease. One factor was removed from wheat germ, previously extracted with petroleum ether, by 70 per cent. ethanol. The other factor was found in the unsaponifiable fraction of wheat germ oil. This suggested that the fat-soluble factor might be vitamin E. However, the dystrophy producing diet apparently contains a significant amount of vitamin E, since both Goettsch and Pappenheimer[1] and Morgulis[4] found

[1] M. Goettsch and A. M. Pappenheimer, *Jour. Exp. Med.*, 54: 145, 1931.

[2] S. Morgulis and H. C. Spencer, *Jour. Nutrition*, 11: 573, 1936.

[3] S. Morgulis, V. M. Wilder and S. H. Eppstein, *Jour. Nutrition*, 16: 219, 1938.

[4] S. Morgulis, "Nutritional Muscular Dystrophy," Hermann and Cie., Paris, 1938.

that female rats grown and maintained on it exhibited "initial fertility" in the first and second generations. We have never observed "initial fertility" in even first generation female rats grown on purified E-deficient diets.

In this connection our attention was directed to the fat-soluble factor by the observation that the paralysis of the hind legs exhibited by adult rats on a highly purified, E-deficient diet, could be prevented by administration of a highly potent vitamin E concentrate.[5] Our experience confirms Goettsch and Pappenheimer's observation that young rabbits, restricted to their diet 13, develop muscular dystrophy and die. We obtained the same results when 10 per cent. of ether-extracted wheat germ was included in the diet. Morgulis[4] noted increased excretion of creatine by rabbits with impending dystrophy. We have recorded the weight, food consumption and creatine excretion, day by day, while rabbits were maintained on diet 13, and have established detailed criteria based on these data, which enable us to predict with considerable certainty when the attack of acute dystrophy will occur. Remedial measures were instituted a few hours before complete collapse was to be expected.

With these criteria as a basis for diagnosis we were able to produce cures in rabbits on diet 13, plus 10 per cent. of ether-extracted wheat germ, by administration of small doses of our vitamin E concentrate.[6] Since the results strongly suggested vitamin E as the curative factor, we next fed natural alpha tocopherol.[7] There was a sharp drop in urinary creatine, accompanied by increased food consumption and gain in weight. Within a few days the animals were able to move about the cages without difficulty, and the creatine output had fallen to the normal level. We have, therefore, shown conclusively that one of the factors, deficiency of which is involved in causing experimental muscular dystrophy in the rabbit, is alpha tocopherol.

This study is being extended and the results will be published in detail elsewhere.

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SCIENTIFIC APPARATUS AND LABORATORY METHODS

"LUCITE" FOR MICROSCOPIC TRANSILLUMINATION

"LUCITE," polymerized methyl methecrylate, is a transparent resin produced by the plastics department of the du Pont de Nemours Chemical Company.[1] It is optically similar to fused quartz in the following ways: it has a high light transmission in the visible spectrum,[2] a beam of light will pass around a bend in the material with very little loss of intensity, and there is a tendency for a beam of light to become concentrated at a constriction in the material. Because of these properties it is therefore well adapted to serve as a substitute for the quartz rod in microscopic transillumination, and has the added advantages of low cost of the material and the ease with which it is machined. Leiter,[3] Knisely[4] and McClung[5] have given the uses and methods of construction of the quartz rod for microscopic transillumination. This is presumably the first report of the use of lucite for this purpose and as a substitute for the Abbe condenser.

CONSTRUCTION OF THE TRANSILLUMINATING ROD

Lucite is easily turned or shaped on either a machine or hand lathe.[2] A piece of one half inch round stock twelve inches in length was used. Four inches of this length were turned to a diameter of one eighth inch on a machine lathe at moderate speed with the application of water to make the cutting smoother. A thirty degree bevel was found to be most satisfactory between the one half and one eighth inch surfaces. Following the cutting operations, the surfaces were polished with jeweler's rouge while the lathe was turning at a high speed until a smooth surface showing no turning marks was obtained. The ends of the rod were polished in the same way. It is necessary to have both ends of the rod flat-surfaced, because distorted surfaces give a field of uneven illumination which makes critical definition impossible. After the rod was completely polished it was ready for the bending operations. The small end was softened in hot oil and bent to the desired angle, care being taken not to distort the small

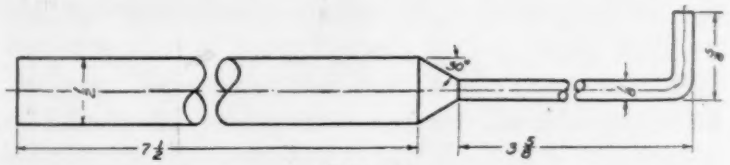

FIG. 1

light-delivering surface (see illustration). The angle of the bend can be varied to meet the special require-

[5] C. G. Mackenzie, J. B. Mackensie and E. V. McCollum. In press.

[1] The Lucite used in this work was graciously furnished by the E. I. du Pont de Nemours and Company, Plastics Department, 350 Fifth Avenue, New York City.

[2] Manufacturer's descriptive pamphlet on Lucite.

[3] S. B. Leiter, *Jour. Optical Soc. Amer.*, 11: 187–189, 1925.

[4] M. H. A. Knisely, *Anat. Rec.*, 64: 499–523, 1936.

[5] C. E. McClung, "Handbook of Microscopical Technique." Paul B. Hoeber, Inc. 2nd ed., 632–642, 1937.

[6] C. G. Mackenzie, J. B. Mackenzie and E. V. McCollum, *Pub. Health Reports*, 53: 1779, 1938.

[7] The alpha tocopherol was furnished by Merck and Co., Inc., Rahway, N. J.

ments of the work for which the rod is intended; however, an angle of ninety degrees was found satisfactory for most general work.

THE USE OF THE ROD FOR TRANSILLUMINATION

The finished rod was supported by a burette clamp on a ring stand where it could then be adjusted to the desired position for operations. The light-delivering end of the rod should be placed in such a position that its surface is parallel to the surface of the microscope objective, this being necessary to produce a field of even illumination. The small tip can be inserted into incisions in live animals such as dogs, cats, rats and frogs for microscopic study of the living organs. For illumination of such tissues as frog or rat mesentery, a sixty-watt lamp placed at the large end of the rod gave sufficient light for observation. For illumination of structures containing pigment, such as liver, a light source of higher intensity will prove more satsifactory. When using the carbon arc for illumination over extended periods, it is necessary to place a water jacket around the large end of the rod to prevent the softening of the rod by the heat from the arc. Lucite rods have been found to give an even field of illumination at both high and low magnifications.

This illuminator may be also used as a very satisfactory substitute for the Abbe condenser and substage mirror of a microscope in general histological work. Sections thus illuminated stand out in brilliant definition. For all general histological sections, a "daylight" sixty-watt lamp gave ample light for oil immersion.

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LANTERN SLIDES FROM TYPEWRITTEN MATERIAL

A METHOD of making lantern slides of tabular and text matter, which eliminates one step in the photographic process, is to type the data through white carbon paper on black paper. The ribbon indicator on the typewriter is set at the position for stencil cutting, to obtain as white an imprint as possible from the carbon paper. The material transferred as white on black paper is then photographed in ordinary daylight (artificial light does not give good results), Eastman contrast lantern slide plates being used as negatives. Each negative is bound with a cover glass as an ordinary lantern slide. This method results in slides that show black letters and figures on a white background and avoids the necessity of making positives after the negatives are made. Kymograph records on smoked paper can be mounted on black paper, the legends typed through the white carbon paper, and both the records and the legends will be reproduced photographically as black on white. Simple curves and diagrams can be traced through the white carbon paper onto the black paper. We have been unable to find a white typewriter ribbon on the market. For black paper we have found the "Black Antique Atlantic Cover" ($20 \times 26 - 65$) of the Cook-Vivian Company satisfactory and for white carbon paper the "Panama White Carbon" of the Manifold Supplies Company, both of Boston.

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BOOKS RECEIVED

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